A Decade Trends in Total and Sex-specific Cerebrovascular Disease Mortality in Turkey: 2013-2022

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ABSTRACT

Objective: Cerebrovascular diseases (CVD) remain a significant global public health concern and a leading cause of mortality. This study aims to assess the current trends in cerebrovascular disease-related mortality in Turkey, with a particular focus on disparities in age and gender. To achieve this, we will utilize mortality data from the Turkish Statistical Institute (TUIK).

Methods: Mortality data for ischemic heart disease from 2013 to 2022 were obtained from the TUIK mortality database. Analytical methods involved the use of Joinpoint analysis to calculate both the annual percentage change (APC) and the average annual percentage change (AAPC). This allowed for the identification of significant alterations in trends over the study period. Additionally, we conducted a detailed examination of sex-specific variations, and age-standardized rates (ASRs) were computed.

Results: In 2013, the total CVD death rate was 25.2%, with male and female death rates of 22.9% and 27.5%, respectively. This year marked the highest recorded stroke death rate within the provided timeframe. By 2022, these rates had consistently decreased. The total stroke death rate was 19.2%, with males at 18.7% and females at 19.7%. The analysis indicated a decreasing trend in CVD mortality in Turkey from 2013 to 2022. However, this decrease was not statistically significant (APC=1.9, 95% CI: -0.8; 4.3, p=0.123). The decline was more pronounced in females (APC=2.4, 95% CI: -0.7; 4.9, p=0.121) compared to males (APC=1.2, 95% CI: -1.3; 3.8, p=0.2351). Comparatively, the latest available data underscore significant disparities in cerebrovascular disease mortality across European regions. Western Europe had the lowest percentage of total deaths attributed to stroke, with 5.9% in males and 8.2% in females. In contrast, Eastern Europe recorded the highest percentages, with 11.6% in males and 17.5% in females. These disparities were reflected in Age-Standardized Mortality Rates (ASMRs), with Western Europe having the lowest ASMRs for stroke and Eastern Europe having the highest.

Conclusion: While there have been global reductions in CVD mortality, Turkey has mirrored these declining trends, albeit at a lower rate than many European countries. The presented results emphasize the need for continual research and improved interventions targeting the observed inequalities in cerebrovascular disease mortality outcomes in Turkey. The regional and sex disparities highlighted necessitate targeted health policies and resource allocation to effectively mitigate cerebrovascular disease-related mortalities.

Keywords: Cerebrovascular disease, mortality, trends, epidemiology, Turkey, age-standardized rates, sex disparities.

INTRODUCTION

In recent decades, there has been a significant decline in mortality from cerebrovascular diseases across Europe, reflecting the overall trends in deaths from cardiovascular diseases (CVD) (1, 2). This decline is attributed to advancements in primary prevention, improved management of risk factors, and enhanced treatment, resulting in reduced incidence and case fatalities (3, 4). However, cerebrovascular diseases continue to be a leading cause of death in Europe, superseded only by ischemic heart disease, accounting for 9% and 13% of all deaths in men and women, respectively (5).
Notwithstanding these improvements, there is a rising concern due to increasing trends in known risk factors, such as obesity and diabetes, stabilized levels of population blood pressure, signalling potential decelerations, or reversals in the progress achieved in reducing cerebrovascular disease mortality (3). Recent analyses indicate that the EU has experienced plateaus or increases in mortality in several countries for both genders. Most existing studies, primarily focused on EU member states, have concentrated on broad disease categories, highlighting the need for more detailed, localized, and diverse research (6).

There is a discernible gap in the research on cerebrovascular disease, one of Turkey's principal causes of death. This study endeavours to address this gap by meticulously examining the most recent trends in CVD mortality rates by age and sex, utilizing data from the Turkish Statistical Institute (TUIK). In this context, this study sought to investigate recent stagnations in gender-specific trends in cerebrovascular diseases in Turkey over the last decade (2013-2022). It conducts an in-depth analysis of trends in cerebrovascular disease mortality in Turkey based on data from the Turkish Statistical Institute (TUIK). It provides insights that complement and contrast existing knowledge from other European nations.

**MATERIAL and METHODS**

**Data Source and Collection**

Population estimates for Turkey were sourced from the TUIK website, allowing the calculation of age- and sex-specific and age-standardized rates (ASRs, utilizing the world standard population and the method of direct standardization). Rates were articulated as deaths per 100,000 people, with ASRs mitigating the effects of historical events on age structure and controlling for differences in age structure in populations.

The Turkish Statistical Institute (TUIK) has been a pivotal source of death and cause-of-death statistics since 2009. The acquired data were based on records located in the Central Population Administration System (MERNİS) database and incorporated the cause of death data from the Ministry of Health's Death Notification System. The cause of death data were meticulously constructed by coding the underlying cause of death in alignment with the World Health Organization’s (WHO) International Classification of Diseases (ICD-10), based on the received death notification forms from the Death Notification System.

**Study Design and Objective**

This research was structured as a comprehensive cross-sectional analysis with the primary objective of studying trends in total and sex-specific cerebrovascular disease (CVD) mortality in Turkey, spanning the decade from 2013 to 2022. The approach and methodology were designed to juxtapose these trends with existing data from European nations with the intention of deriving insights into broader patterns and disparities in CVD mortality.

**Data Acquisition and Reliability**

To ensure the precision and reliability of our study findings, the primary data were meticulously sourced from reputable databases and national repositories, including...

1. **Worldometer Database (as of 15/09/2023):** Providing up-to-the-minute statistics related to CVD mortality (7).
2. **OECD Digital Database (2023):** Supplying sociodemographic data and vital health-related indicators for Turkey and European Union countries, enriching the comparative dimension of the study (8).
3. **Turkish Statistical Institute (2013-2022):** Serving as an essential reference for national databases on CVD mortality, substantiating the depth and breadth of our research (8).

**Ethical Consideration**

The utilization of publicly available and unrestricted data from the Turkish Statistical Institute and World Health Organization obviated the necessity for ethics committee permission, ensuring adherence to ethical research standards throughout the study.

**Data Compilation and Statistical Analysis**

Descriptive data and corresponding tables were assembled using the MS Excel program, the IBM SPSS (v.20) package program facilitated comprehensive statistical analysis. Correlations between the datasets of countries were evaluated using Spearman and Pearson correlation analyses, maintaining an upper alpha error rate limit of 5% in the study.

The harvested data, including variables such as CVD mortality rates, sex-specific mortality, and sociodemographic parameters, were thoroughly collated and scrutinized. Comparative analyses were instrumental in revealing the correlations, trends, and discrepancies in CVD mortality.

**RESULTS**

This study encompasses a detailed examination of 10 years using death statistics data from the Turkish Statistical Institute (TUIK). The data illustrated longitudinal changes in cerebrovascular disease mortality, exploring trends in both male and female populations over a specified timeframe. The mortality rates with the diagnosis of CVD and age-standardized rates between 2013 and 2022 are presented in Table 1.

The investigation highlighted a trend of reduction in Cerebrovascular Disease (CVD) mortality rates in Turkey from 2013 to 2022; nevertheless, statistical analysis indicated that this declining trend did not attain statistical significance (APC=1.9 (−0.8; 4.3), p=0.123).

**Delving deeper into gender-specific data:**

It was observed that the declining gradient was more prominent in females (APC=2.4, 95% CI: -0.7; 4.9, p=0.121) than in their male counterparts (APC=1.2, 95% CI: -1.3; 3.8, p=0.235). Additionally, the age-adjusted mean mortality rate, standardized to the global population norms for CVD in Turkey, showed a descending trend from 2013 to 2022. However, similar to the previously noted trend, this augmentation did not reach statistical significance (APC=1.7 (−0.8; 4.3), P=1.66). In the detailed breakdown over the 2013-2022 span, the APC value for the general population was at 1.7 (−0.8; 4.3, P=1.66). Interestingly, females showed a relatively elevated APC value of 2.2 (−0.7; 5.2, P=1.21) when compared to males, who had an APC value of 1.4 (−1.1; 3.9, P=0.235) (Figure 1).
When juxtaposed with European nations, clear distinctions in CVD mortality trends surfaced. Western Europe marked the minimal percentage of total deaths attributed to stroke with 5.9% in males and 8.2% in females, opposing Eastern Europe, where the recorded percentages peaked at 11.6% in males and 17.5% in females.

It is imperative to acknowledge that the variations in Age-Standardized Mortality Rates (ASMRs) were also profound, with Western Europe in the lower spectrum and Eastern Europe in the upper spectrum. Table 2 meticulously contrasts the ongoing trends in Cerebrovascular Disease mortality between Turkey and European countries, providing an analytical comparison of the shifting patterns in CVD mortality rates.

Table 1: Annual Deaths and Stroke Death Rates from 2013-2022

<table>
<thead>
<tr>
<th>Year</th>
<th>Total N</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>504839</td>
<td>19.2</td>
<td>18.7</td>
<td>19.7</td>
</tr>
<tr>
<td>2021</td>
<td>566485</td>
<td>18.9</td>
<td>18.6</td>
<td>19.2</td>
</tr>
<tr>
<td>2020</td>
<td>507938</td>
<td>19.6</td>
<td>19.1</td>
<td>20.1</td>
</tr>
<tr>
<td>2019</td>
<td>435941</td>
<td>22.3</td>
<td>21.7</td>
<td>22.9</td>
</tr>
<tr>
<td>2018</td>
<td>426106</td>
<td>22.2</td>
<td>21.6</td>
<td>22.8</td>
</tr>
<tr>
<td>2017</td>
<td>425781</td>
<td>22.9</td>
<td>22.3</td>
<td>23.5</td>
</tr>
<tr>
<td>2016</td>
<td>422726</td>
<td>23.5</td>
<td>22.8</td>
<td>24.2</td>
</tr>
<tr>
<td>2015</td>
<td>405218</td>
<td>24.3</td>
<td>23.6</td>
<td>25.0</td>
</tr>
<tr>
<td>2014</td>
<td>319009</td>
<td>24.5</td>
<td>23.8</td>
<td>25.2</td>
</tr>
<tr>
<td>2013</td>
<td>372094</td>
<td>25.2</td>
<td>22.9</td>
<td>27.5</td>
</tr>
</tbody>
</table>

Figure 1. Temporal Trends and Gender Disparities in Age-Standardized Cerebrovascular Disease Mortality Rates in Turkey (2013-2022)

Table 2: Comparative Synopsis of Recent Trends in Cerebrovascular Disease Mortality Between Turkey and European Countries

<table>
<thead>
<tr>
<th>Regions/Countries</th>
<th>Turkey (%)</th>
<th>Western Europe (%)</th>
<th>Eastern Europe (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant Decrease in CVD</td>
<td>2.4</td>
<td>8.2</td>
<td>11.6</td>
</tr>
<tr>
<td>Significant Increase in CVD</td>
<td>1.2</td>
<td>5.9</td>
<td>17.5</td>
</tr>
<tr>
<td>No Significant Change in CVD</td>
<td>1.9</td>
<td>4.6</td>
<td>5.7</td>
</tr>
</tbody>
</table>

*Decreasing (Significant): represents trends where the final segment is significantly decreasing and more negative than the previous segment, or for trends without joinpoints, it signifies an overall significant decrease.

**Stabilizing (No change): implies that the final segment is still decreasing but is less negative than the previous segment, representing a potential stabilization in the trend.

***Increasing (Significant): denotes trends where the final segment is significantly increasing or, for trends with no joinpoints, an overall significant increase is observed.
DISCUSSION

Although not statistically significant, the decreasing trend in cerebrovascular disease mortality is an encouraging observation from the Turkish data between 2013 and 2022. This mirrors the findings across much of Europe, where cerebrovascular disease mortality has shown substantial decline in recent decades. The European landscape, especially Western Europe, has experienced a decline attributed to enhanced primary prevention, improved risk factor management, and progressive strides in treatment and care protocols. Despite these reductions, cerebrovascular diseases remain a pivotal cause of death (4, 9, 10).

Interestingly, gender-specific data from Turkey suggest that the downward trend in mortality is more pronounced among females. Similar sex-specific trends have been observed in some European studies, which postulated that potential biological, social, and healthcare accessibility factors might influence these differences (1, 6, 11). It remains crucial for future research to delve deeper into the potential reasons for the observed gender discrepancy.

When juxtaposed with European data, Turkey's mortality rate demonstrated both unique trends and common patterns. The lower percentage of total deaths attributed to stroke in Western Europe might be indicative of more advanced preventive strategies, awareness campaigns, and access to timely and effective treatments. In contrast, Eastern Europe, with its higher mortality percentage, might be grappling with healthcare accessibility issues, sociopolitical challenges, or varying prevalence of risk factors (6, 12, 13).

It is also important to note the changing landscape of risk factors. The increasing prevalence of obesity, diabetes, and other metabolic syndromes is becoming a global concern (1, 4). As suggested by recent studies, plateauing or even increasing trends in some European countries might be early indicators of these shifting epidemiological patterns (14, 15). For Turkey, taking cognizance of these evolving European patterns is crucial to preempt any further increase in mortality.

Furthermore, as per our data, although declining, the age-adjusted mean mortality rate in Turkey necessitates comprehensive public health strategies. The differences between male and female APC values further highlight the need for sex-specific strategies.

CONCLUSION

In conclusion, this study highlights a notable decline in cerebrovascular disease mortality in Turkey from 2013 to 2022, although the statistical significance of this decline remains uncertain. Aligning with broader European trends, Turkey should prioritize advanced preventive strategies, health awareness promotion, timely access to treatment, and addressing emerging risk factors. The observed gender-specific differences suggest a need for tailored interventions. As cerebrovascular diseases continue to pose a significant health challenge, a multifaceted, evidence-driven strategy is crucial to further reduce the burden of this disease in Turkey.
